Objective:

(i) To study the angle of deviation (d) with angle of incidence (i) and to find the angle of minimum deviation (D) from i-d curve.

(ii) To find the refractive index of the material of the prism using angle of prism (A) and angle of minimum deviation (D).

Materials required:

Glass prism, Drawing board, Paper, Pins, Pencil, Scale and Protractor.

Precautions:

1. The angle of incidence should lie between $35^0 – 60^0$
2. The pins should be fixed vertical.
3. The distance between the two pins should not be less than 10 mm.
4. Arrow heads should be marked to represent the incident and emergent rays.
5. The same angle of prism should be used for all the observations.

Theory:

Prism: A prism is an optical element. It has polished flat surfaces that refract light. The traditional geometric shape of a prism has a triangular base and two rectangular sides. It is called triangular prism.

A prism can be made from materials like glass, plastic and fluorite. It can be used to split light into its components.

How a Prism Works

When light travels from one medium to another medium, it is refracted and enters the new medium at a different angle. The degree of bending of the light's path depends on the angle that the incident beam of light makes with the surface of the prism, and on the ratio between the refractive indices of the two media. This is called Snell's law.

$$n = \frac{\sin i}{\sin r}$$

where, n is the refractive index of the material of the prism.
'i' is the angle of incidence.
'r' is the angle of refraction.

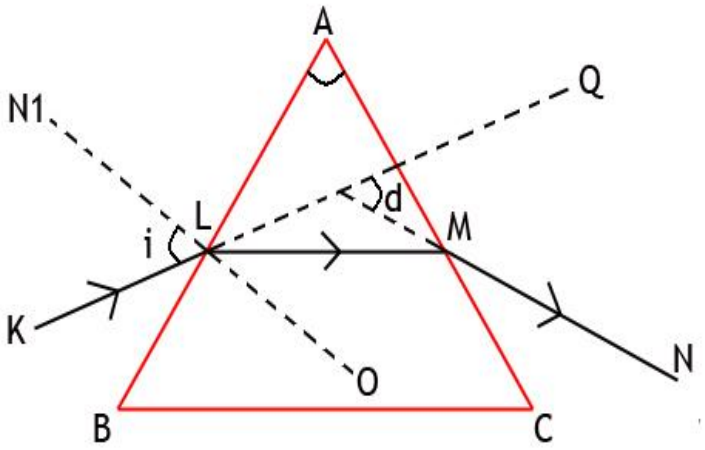
The refractive index of many materials varies with the wavelength of the light used. This phenomenon is called dispersion. This causes light of different colors to be refracted differently

and to leave the prism at different angles, creating an effect similar to a rainbow. This can be used to separate a beam of white light into its constituent spectrum of colors.

The relation between Refractive Index (n), Angle of Prism (A) and Angle of Minimum Deviation (D)

The angle A between the two refracting surfaces ABFE and ACDE is called the angle of prism.

A ray of light suffers two refractions on passing through a prism. If KL be a monochromatic light falling on the side AB, it is refracted and travels along LM. It once again suffers refraction at M and emerges out along MN. The angle through which the emergent ray deviates from the direction of incident ray is called angle of deviation 'd'.

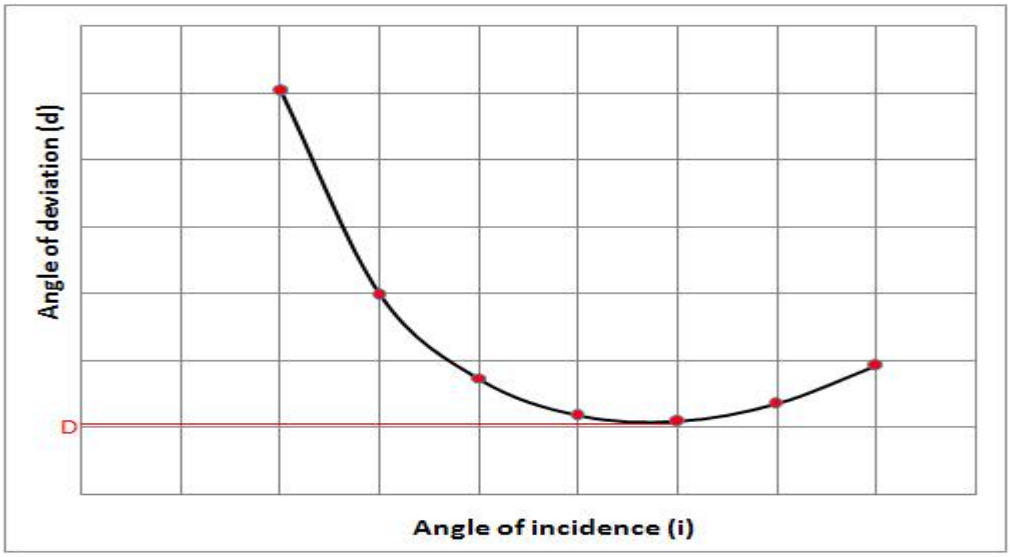


As the angle of incidence is increased, angle of deviation 'd' decreases and reaches minimum value. If the angle of incidence is further increased, the angle of deviation is increased.

A graph is drawn between angle of incidence (i) and angle of deviation (d) by taking angle of incidence (i) along X-axis and angle of deviation (d) along Y-axis. It should be a curved graph.

The angle of minimum deviation is obtained from the graph. Let D be the angle of minimum deviation, then the refractive index (n) of the material of the prism is calculated using the formula,

$$n = \frac{sin\frac{(A+D)}{2}}{sin\frac{A}{2}}$$



Procedure:

- A paper is fixed on the drawing board placed on the table.
- Place the given glass prism on the center of the paper.
- Using the pencil, mark the outline ABC of the prism on the paper.
- Remove the prism, and using the scale and pencil, normal N1O is drawn to the face AB at the point L.
- Using the protractor, measure an angle 30° from the normal.
- Another line KL is drawn at L making the angle 30° (angle of incidence i) with the normal N_1O.
- Two pins R_1 and R_2 are fixed on this line.
- The prism is replaced on the outline ABC.
- Viewing the pins from the face AC of the prism, two other pins R_3 and R_4 are fixed so that R_1, R_2, R_3 and R_4 are in a line.
- Remove the pins.
- A line NM is drawn to meet on the face AC through the marks of R_3 and R_4.
- The line LM is joined.
- The line KL is extended to get the LQ and NM is extended to get the line MP. These two lines meet at P.
- Using the protractor, measure the angle QPM. This is the angle of deviation d.
- Repeat the experiment for different values of angle of incidence (i) and the corresponding angle of deviations are measured.
- Draw a graph with angle of incidence (i) along the X-axis and angle of deviation (d) along the Y – axis.

- The angle of deviation corresponding to the lowest bend of the curve is the angle of minimum deviation (D).
- Angle of the prism A is directly measured from the outline of the prism using the protractor.
- Calculate the refractive index of the material of the prism using the formula,

$$n = \frac{sin\frac{(A+D)}{2}}{sin\frac{A}{2}}$$

Observations:

Sl. No.	Angle of Incidence (i)	Angle of Deviation (d)
1	35	
2	40	
3	45	
4	50	
5	55	
6	60	

Calculations:

- Angle of prism (A) = 60°.
- From graph, angle of minimum deviation D = ----------°
- Refractive index of the material of the prism,

$$n = \frac{sin\frac{(A+D)}{2}}{sin\frac{A}{2}}$$

Results:

- A graph showing the variation of angle of deviation with the angle of incidence is plotted.
- Angle of minimum deviation, D = --------°
- Refractive index of material of the prism, n = ----------